Remarks

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 1-39 are pending in the application, with claims 1, 11, 22, 33, and 37 being the independent claims. No new claims are sought to be added. Claims 1, 11, 22, 33, and 37 are sought to be amended. No claims are sought to be cancelled. No new matter is introduced.

Based on the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding rejections and that they be withdrawn.

Response to Amendment and Arguments

The Examiner requests that the Applicants clarify which far-end signal is referred to with respect to the 'Hybrid H' block in Applicants FIG. 7. An explanation is given in the following.

The far-end signal has both an acoustic echo generated in the near-end and an electrical echo generated at the 2 wire-4 wire hybrid at the network interface to the near-end. An acoustic echo is generated in the near-end when the speaker in the near-end receive channel is acoustically coupled to the microphone in the near-end transmit channel, repeating the far-end signal into the near-end transmit channel.

An electrical echo is generated at the 2 wire-4 wire hybrid at the network interface to the near-end by reflection of the far-end signal due to an impedance mismatch at the 2 wire-4 wire hybrid between the 2 wire telephone line and the 4 wire network line.

Both acoustic and electrical echoes are cancelled by adaptive filter W 200 in FIG. 7. It may be pointed out that microphone 330 and speaker 329 are connected to near-end transmit and receive lines, respectively, coupled by a second hybrid to the 2 wire telephone line. This distinction is made more clearly in FIGs. 4-5, where the near-end transmit and receive channels are subsumed by the telephone icon coupled to the 'Hybrid' block.

The delay in the electrical path between the microphone 330 and speaker 329 in the near-end is essentially zero, so a cheap transformer-based attenuator can be used to simply reduce the electrical reflection from the near-end hybrid. Near-end reflection from the second hybrid allows the person talking at the near-end to hear his or her own voice, a desirable feature.

Echo cancellation of the electrical reflection at the near-end hybrid *is* required in both hands-free phones and speaker phones. The electrical signal from the microphone reflects at the hybrid to speaker amplifier, and acoustically couples back into the microphone, producing an audible delay.

Rejections under 35 U.S.C. § 103(a)

Claims 1-3, 6, 8-12, 14, 15, 17-20, 22, 23, 25, 27-31, 33, 36, and 37 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over W.E. Eppler, Jr. et al., "Conference Telephone Using Dynamic Modeled Line Hybrid", U.S. Patent No. 5,600,714, February 4, 1997 ("Eppler"), in view of B.M. Finn, "Acoustic Echo Cancellation in an Integrated Audio and Telecommunication System", U.S. Patent

No. 5,706,344, January 6, 1998 ("Finn"). Applicants respectfully traverse and request reconsideration.

With respect to independent claim 1, the Examiner contends that Eppler discloses "...an echo canceller..." in FIG. 1, comprising an "...adaptive filter..." , represented by element [24] in FIG. 1, with "...coefficients...adapted to cancel...an...echo..." in the near end. The Examiner further contends that Eppler does not disclose cancellation of "...a secondary audio signal...", but that Finn does disclose cancellation of a near end secondary audio signal, and a means to combine secondary audio with far end telephony reflections, and that these elements are disclosed by Finn in column 1, lines 23-44.

As amended herein, independent claim 1 includes the element of an adaptive filter having filter coefficients dynamically adapted to cancel an echo in a near end signal, the echo comprising an acoustic echo and an electrical echo. An adaptive filter, as proposed by the Applicants, can be updated *dynamically*; that is, adaptive filter coefficients can be reconfigured *dynamically* based on far-end voice and/or audio transmission, requiring no additional or intermittant training period, restricted to an artificial white noise training signal, as prescribed by both Eppler and Finn.

The Applicants respectfully disagree with the Examiners' contention that either Eppler or Finn disclose an "...adaptive filter having filter coefficients dynamically adapted to cancel a combination of an electrical and an acoustical echo in a near end signal...", as recited in amended claim 1. To the contrary, Eppler uses a filter that is adaptive when initially trained with white noise, but is fixed following training, and does not adapt to far end echo. An explicit description of the adaptive

filter and training procedure is given by Eppler in column 8, lines 23-32 and lines 52-57. Thus, Eppler does not teach the dynamic nature of the independent claim 1. Furthermore, Eppler's approach teaches a very different approach from claim 1, in that Eppler relies upon white noise for training, while independent claim 1 relies upon a real time telephony signal and acoustical echo to dynamically filter echo. Reliance on white noise for training in a static manner undermines a fundamental purpose of claim 1 of providing a dynamic filter for adjusting to real time changes in echo. Because Eppler teaches away from independent claim, Eppler can not be combined with any other reference as a basis for rejecting independent claim 1.

Similar to Eppler, Finn trains an LMS filter continuously on low-level white noise for echo cancellation. The LMS filter is described by Finn in column 3, lines 52-59; the white noise driven echo cancellation is described by Finn in column 4, lines 36-49. By contrast, the Applicants adaptive filter is updated by signal echo, requiring a more sophisticated filter, as characterized in claim 1, than that of Eppler or Finn, both of whom update filter coefficients by simply injecting white noise into the near end receive channel.

Thus, like Eppler, Finn fails to teach the element of an adaptive filter having filter coefficients dynamically adapted to cancel an echo in a near end signal, the echo comprising an acoustic echo and an electrical echo (and in fact teaches away in a manner similar to what was described with respect to Eppler). For at least these reasons, independent claim 1 is patentable over the cited references. Reconsideration and allowance of independent claim 1 is respectfully requested.

The Examiner has rejected independent claims 11, 22, 33, and 37 using the identical arguments used in rejecting independent claim 1. Arguments made by the Applicant for claim 1 apply equally to independent claims 11, 22, 33, and 37. For at least these reasons, independent claims 11, 22, 33, and 37 are also patentable over the cited references. Reconsideration and allowance of independent claims 11, 22, 33, and 37 is respectfully requested.

Claims 2-3, 6, and 8-10 are dependent on independent claim 1. Claims 12, 14, 15, and 17-20 are dependent on independent claim 11. Claims 23, 25, and 27-31 are dependent on independent claim 22. Claim 36 is dependent on independent claim 33. Arguments for these independent claims have been made in the preceding paragraphs. For at least these reasons, dependent claims 2-3, 6, 8-10, 12, 14, 15, 17-20, 23, 25, 27-31, and 36 are also patentable over the cited references. Reconsideration and allowance of these dependent claims is respectfully requested.

Claims 13 and 24 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Eppler in view of Finn. Claims 13 and 24 are dependent on independent claims 11 and 22, respectively. Arguments for independent claims 11 and 22 have been made in the preceding paragraphs. For at least these reasons, dependent claims 13 and 24 are also patentable over the cited references. Reconsideration and allowance of claims 13 and 24 is respectfully requested.

Claims 4, 21, 32, 35, and 39 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Eppler in view of Finn, and further in view of G.C. Sih,

"Double-Talk Detection by Means of Spectral Content", U.S. Patent No. 5,732,134, March 24, 1998 ("Sih"). Applicants respectfully traverse and request reconsideration.

The Examiner contends that Eppler and Finn disclose an echo cancellation system for primary reflection and secondary audio signals. The Examiner contends that Eppler and Finn fail to disclose double talk logic, but that Sih *does* disclose "...double talk logic to detect speech in the near end signal...", described in Sih, column 1, lines 52-67. The double talk logic disclosed by Sih is spectral based. *Id.* at FIG. 2, *see,* elements [40], [42], and [44].

Sih does not overcome the shortcomings of Eppler and Finn discussed above as a basis for rejecting the independent claims. Thus, for at least reasons given above, dependent claims 4, 21, 32, 35; and 39 are also patentable over the cited references. Reconsideration and allowance of claims 4, 21, 32, 35, and 39 is respectfully requested.

Claim 5 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Eppler in view of Finn, and further in view of E.H.M. Sellenslagh et al., "Telephone Pulse Metering System", U.S. Patent No. 3,433,898, March 18, 1969 ("Sellenslagh"). Applicants respectfully traverse and request reconsideration.

With respect to dependent claim 5, the Examiner contends that Eppler and Finn disclose an echo cancellation system for primary reflection and secondary audio signals. The Examiner contends that Eppler and Finn fail to disclose cancellation of a secondary audio signal, where the "...secondary audio signal comprises a pulse

metering tone." The Examiner contends that Sellenslagh *does* disclose pulse metering tone cancellation.

Applicants respectfully disagree. Sellenslagh is concerned with the specification of a pulse metering system for telephone systems, but nowhere in the Sellenslagh patent application text nor in the Sellenslagh patent application FIGs. 1-15 does Sellenslagh teach or suggest echo cancellation of any kind. For at least these reasons and those given above for claim 1, dependent claim 5 is patentable over the cited references. Reconsideration and allowance of claim 5 is respectfully requested.

Claims 7, 16, 26, 34, and 38 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Eppler in view of Finn, and further in view of A. Hasegawa, "Echo Canceller for a Packet Signal", U.S. Patent No. 5,905,717, May 18, 1999 ("Hasegawa"). Applicants respectfully traverse and request reconsideration.

With respect to dependent claims 7, 16, 26, 34, and 38, the Examiner contends that Eppler and Finn disclose an echo cancellation system for primary reflection and secondary audio signals. The Examiner contends that Eppler and Finn fail to disclose "...a decimator that downsamples the secondary audio signal to match a sample rate of the primary telephony signal." The Examiner contends that Hasegawa *does* disclose decimation of the audio signal in column 1, lines 15-27.

Applicants respectfully disagree. Hasegawa does not decimate, Hasegawa unpacks received packet data to prepare the data for filtering. Hasegawa does not interpolate, Hasegawa packs data to prepare the data for packet transmission.

Decimation and interpolation require significantly more processing than simply unpacking and packing. Decimation presents aliasing concerns, unpacking does not. Interpolation requires properly constructed finite impulse response filters (FIRs) and attention to the requisite processing, packing does not. Decimation and interpolation are distinctly different and more complex functions than unpacking and packing.

Hasegawa decimation (resampling) requires buffering and reclocking high-rate packet data signals, reducing the data rate to the point where an adaptive FIR filter can function. Hasegawa decimation is described explicitly in column 1, lines 15-27. In FIG. 1, element [1], Hasegawa buffers and decimates, or unpacks, the packet data prior to adaptive filtering, element [3]. In FIG. 1, element [5], Hasegawa buffers and interpolates, or repacks, the packet data prior to transmission. Signal models for unpacking (decimation) and repacking (interpolation) are given by Hasegawa in FIGs. 5A,B and 7A,B, respectively.

Hasegawa resampling is different than that of the Applicants. In claim 7, the Applicants echo cancellation "...downsamples the secondary audio signal to match a sample rate of the primary telephony signal...", or voice signal, the secondary audio signal comprising near end audio and pulse metering tones, as given in Applicants FIG. 7, elements [304] and [340]. Buffering data is not necessary in claim 7; voice data, unlike packet data, is not transmitted and received in high-rate data bursts. For at least these reasons and those given above for claim 1, dependent claims 7, 16, 26, 34, and 38 are patentable over the cited references. Reconsideration and allowance of claims 7, 16, 26, 34, and 38 is respectfully requested.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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